R Craigie
with the kind regards of the
Author

INTRODUCTORY LECTURE

DELIVERED AT THE COMMENCEMENT OF THE

WINTER SESSION 1864-65,

IN THE

MEDICAL SCHOOL, SURGEONS' HALL,

EDINBURGH.

BY

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EDINBURGH: PRINTED BY OLIVER AND BOYD.

MDCCCLXIV.

REPRINTED FROM THE EDINBURGH MEDICAL JOURNAL FOR DECEMBER 1864.

INTRODUCTORY LECTURE,

Delivered on 1st November 1864.[1]

Mr President and Gentlemen,

The commencement of a Winter Session in this Medical and Surgical School has for a number of years been made the opportunity of the delivery of an introductory address; and, in order of seniority of lectureship, I am called upon to-day to fulfil the task of breaking the silence of the vacation, and of sounding the alarm note which is the prelude to the regular work of the session.

To the senior students who have returned once again to these benches, and whose familiar faces connect bygone years with the present, let me, in a word, in the name of my colleagues and myself, bid you most heartily welcome back again to the scene of your professional labours: and to the junior students, who this year begin their medical career, and who occupy the benches of a medical and surgical class-room for the first time, let me as heartily bid you welcome to these rooms.

That senior and junior students should each in their turn have imparted to them an enlightened and well-grounded knowledge of the profession of medicine and surgery is the earnest desire of all my colleagues and myself, and that after-success in life may be the lot of you all is the heartfelt wish of each one of us.

In the professional study of medicine, many branches of science require to be attended to; and though some may be reckoned as more important than others, yet none can be regarded as not essential. It is true that a surgical operation, to be successful, need not require a knowledge of the chemistry of the bone or the muscle; and it is equally true that the administration of an opiate or a purgative does not necessitate a knowledge of systematic or practical surgery.

At no previous time, however, has it been more apparent, that the various branches of medical science form part of one great whole; and that it is almost impossible to draw the line between one branch and another. It would be difficult to say where chemistry ends and materia medica begins, or where chemistry ends and physiology begins; for the chemical properties and actions of substances can be scarcely understood without a knowledge of their

[1] Dr Burt, President of the Royal College of Physicians occupied the Chair, and amongst others there were present, Benjamin Bell, Esq., President of the Royal College of Surgeons; Dr Craigie, Ex-President of the Royal College of Physicians; Dr Alexander Wood, Dr Seller, Dr Pattison, Dr Cumming, Dr Renton, Dr Huie, Dr Dumbreck, Dr Dunsmure, Dr Dyeer, Dr P. H. Watson, Dr Joseph Bell, Mr Annandale, Dr A. C. Brown, Dr Sanders, Dr Gillespie, Dr P. D. Handyside, Dr Rutherford Haldane, Dr Warburton Begbie, Dr Grainger Stewart, Dr Keiller, Dr Scoresby-Jackson, and Dr Husband.

chemical composition; and the relations of food to the animal system in the building up and breaking down of the animal frame, can only be darkly determined without a knowledge of the composition of diet and of the bodily structure. And more than that, the physician and surgeon of the present day is required to learn the lesson that his duties demand that he shall not only be well versed in the treatment of serious ailments, and the performance of formidable operations, but that he should know well the common-sense science of every-day life. That he should understand the natural relations of man to the world around him, and remember that prevention is better than cure. That he should intelligently advise and arrest the causes of those little illnesses which enfeeble the constitution and render it open to serious ailments.

Much can undoubtedly be done by preventive measures; and though at first sight it would appear to narrow-minded men to be bad policy for the physician and surgeon to keep people well and prevent them from getting ill, yet the intelligent and right-minded medical practitioner knows that, whilst much ill health in a family betokens, in most instances, pinched means and scanty fees, better health signifies family prosperity, more liberal fees, and grateful hearts and thanks besides.

Much attention has recently been devoted to the important question of the diet of all classes; and the British Government has the credit of being the first to institute an official inquiry into the relative nutritive values of the various diets. This country is still the only one where the food of the people has been made the subject of a Government commission. The dietary scales adopted in this country are of the most varied description, not only in regard to kind or quality, but also in regard to quantity. And whilst each household is free to use what special article of diet they may fancy, even prisons, workhouses, and barracks conform to separate systems or scales, which often present the greatest anomalies.

The inquiry is of great moment to all classes; not only to the under-fed class, who ought to be told what articles and mixtures of food are most profitable in a nutritive point of view, and how they can best spend their pence, but to the over-fed class of all grades, so that they may know what quantities of food are consistent with the healthy state of the system, and beyond which indulgence must lead to superfluity, which is surfeit, with the evils attendant thereon. The whole question of the diet of the people is of the greatest importance to the medical practitioner, who may be called upon to report upon the victualling of barracks at home and abroad, who may have the medical charge of men-of-war at home or at foreign stations, or who may have the medical convoy of emigrant or troop ships: who may also have the medical supervision of prisons or workhouses, or who may have the more general work of a parochial surgeon. Questions as to the sufficiency of the diet, or as to the advisability of an alteration therein may be submitted to him, and the many awkward changes which have been made at times in the

diets of the population of our prisons and workhouses show, that a knowledge of the principles which ought to regulate the diet of a people has not received that professional attention which the importance of the subject demands.

The first attempt at a proper scientific classification of diet was made by Liebig, who divided the elements of food into *heat-producing* and *flesh-forming;* and he likewise noticed the importance of the saline substances which generally accompany and are partaken of along with the more ordinary food. Dr Edward Smith has recently gone into the whole subject of the classification of food with the greatest care, and he is inclined to determine the value of the components of food according to the quantity of *carbon* and of *nitrogen*. This view is practically the same as that of Liebig; for the *heat-producing* elements of food are those whose *carbon* can be readily burned within the living system, and thus supply the animal warmth; whilst the *flesh-forming* ingredients are those which contain *nitrogen*, and whose particular office in the living frame is to replenish the flesh or muscle which is daily being disintegrated, and the momentary destruction of which, constitutes the ordinary wear and tear of the animal system.

The relative proportions of the *heat-producing* or *carbon* elements and the *flesh-forming* or *nitrogen* elements of food vary much, and the cost of their purchase, likewise, differs greatly in even the more common articles of ordinary consumption. Besides, there is the important question of the relative digestibility of the various ingredients found in food, as exemplified in the cases of starch, gum, sugar, and oil, on the one hand, and lignin or woody fibre on the other; the latter being as strictly one of the heat-producing or carbon elements of food as either of the former. A good instance of the difference of the feeding value of similar substances occurs in the case of white bread and brown bread. The former or white bread, when dried at 212° F., yields about 2·27 per cent. of nitrogen, which is equal to 14·8 per cent. of flesh-forming ingredients; whilst the brown bread contains about 2·63 per cent. of nitrogen, which is equivalent to 16·43 per cent. of flesh-forming ingredients. The brown bread, therefore, which is made from the whole grain, is richer in nutritive matter than the white bread; but the husky part of the grain which is present in the brown bread, and contains some of the nitrogen, is much more difficult of digestion than the finer flour. Moreover, the brown bread, from the comparative gritty character of the husk, causes an irritation in the alimentary canal, and tends to purge the individual, and thus causes the nutritive matters to pass out of the system before time has been allowed for their proper digestion and assimilation. In fact, the bran acts medicinally, and a knowledge of its tendency to physic is very much the reason of its employment in part by the better classes. The giving of brown bread to the farm labourers of England has proved that the diet is not a satisfying one, and its adoption in some of the prisons for a short time led to the exhibition of symptoms of

an insurrection among the inmates. Children, likewise, who have often correct instinctive notions regarding the value of articles of food, almost universally dislike and condemn brown bread.

Dr Edward Smith, taking ordinary white bread as his standard, has constructed several instructive tables of the relative values of the various articles of diet. One lb. of white bread contains about 2000 grains of carbon and 89 grains of nitrogen, and costs, on the average, $1\frac{3}{8}$d., nearly $1\frac{1}{2}$d.; and reducing these proportions to the value of 1d., the following table of the amount of carbon and nitrogen which can be purchased in various common articles of food for 1d. has been constructed:—

	1d. worth of—		Carbon.		Nitrogen.	
	Ordinary white bread contains	.	1450 grains	and	66 grains.	
From Vegetable Kingdom.	Oatmeal,	„ .	1513	„	„ 75	„
	Indian corn or maize,	„ .	2800	„	„ 121	„
	Peas, whole,	„ .	1820	„	„ 170	„
	Rice,	„ .	1380	„	„ 35	„
	Potatoes,	„ .	1540	„	„ 49	„
	Vegetables (mean),	„ .	1230	„	„ 42	„
	Sugar,	„ .	622	„	„ —	„
From Animal Kingdom.	Beef,	„ .	320	„	„ 23	„
	Mutton,	„ .	415	„	„ 20	„
	Pork,	„ .	483	„	„ 18	„
	Fat (suet),	„ .	657	„	„ —	„
	Butter,	„ .	327	„	„ —	„
	New milk (mean),	„ .	409	„	„ 33	„
	Skimmed milk (mean),	„ .	874	„	„ 87	„
	Butter milk (mean),	„ .	1676	„	„ 175	„
	Cheese (mean),	„ .	557	„	„ 81	„

The relative values at which the carbon and nitrogen elements in food can be purchased may be more readily observed from the following statements.

The standard quantity of carbon procurable from 1d. worth of wheaten bread may be obtained in maize or Indian corn for $\frac{1}{2}$d., in peas, vegetables, potatoes, rice, buttermilk, and oatmeal at from $\frac{1}{2}$d. to 1d., in skimmed-milk cheese, from $1\frac{1}{2}$d. to 2d., in suet, sugar, and lard, from 2d. to $2\frac{1}{2}$d.; in new milk, pork, mutton, beef, and butter, from 4d. to $4\frac{1}{2}$d.

The standard amount of nitrogen as derived from bread at 1d. may be procured from buttermilk, peas, and Indian corn, at $\frac{1}{2}$d.; from skimmed-milk cheese and oatmeal, at $\frac{3}{4}$d.; from potatoes and vegetables, at $1\frac{1}{2}$d.; from rice and new milk, at 2d.; from beef, mutton, and pork, at 3d.

The average daily allowance of carbon and nitrogen for an adult has been calculated to be 4600 grains of carbon, and 300 grains of nitrogen, as these proportions of carbon and nitrogen are evolved as carbonic acid and ammonia by the lungs and the pores of the skin, and as urea, uric acid, and other compounds by the kidneys and bowels. Dr Edward Smith has calculated that the labouring classes of England receive daily in their food an average proportion of 5279 grains of carbon, and 216 grains of nitrogen,

and they preserve their health; so that these proportions may not be regarded as under the proper allowance. A mixed diet of vegetable and animal matter is preferable, as the vegetable matter is generally deficient in nitrogen, but contains an excess of carbon, and the animal matter has a deficiency of the carbon element and an excess of nitrogen; so that when the vegetable and animal matters are conjoined, the proper proportions are obtained. Animal food, moreover, is readily assimilated, and hence, though dearer at first cost, yet is more valuable from the facility of its appropriation by the animal frame. Vegetable food, on the other hand, has an important influence in sustaining the animal system in a good, healthy condition; and the benefits derivable from the liberal use of fresh vegetables and fruits in scurvy are well known.

The allowance of food in the British navy is from 31 to 35½ oz. of dry food per day; of which about 26 oz. are vegetable, and the remainder is animal. The ordinary ration of a British soldier is ¾ lb. of mutton or beef, 1 lb. of bread, 1 lb. of potatoes, and tea and coffee for breakfast and supper. These quantities are regarded as barely sufficient for the wants of a recruit at hard work at drill, but sufficient for a corporal, who has less expenditure of muscular force, or for an old soldier who is leaving the ranks. In the military prisons in Ireland, the soldiers who are prisoners receive daily 8 oz. oatmeal, 8 oz. Indian corn meal, 8 oz. wheaten bread, and 1½ pint of milk; the whole being divided into three meals; and the healthiness of this diet is observable in the fact that, whilst the mortality in the British army was at the rate of 17 in 1000, that in the military prisons in Ireland was only 2½ per 1000.

The average proportional quantity of food consumed by various classes of society has been reckoned as follows:—

Agricultural labourers,	122
Artisans, first class,	140
Paupers,	150
Soldiers,	168
Prisoners in jail,	217
Convicts in hulks, or transported felons,	237

In the prisons of England the quality and nature of the diet varies so much that the cost per head ranges from 1s. 2d. to 5s. and even 7s. each week.

In common-sense cooking, when soup only is being prepared, the meat is put into the water when it is cold, and the whole is then gently warmed; whilst, when the meat is required as well, it should be placed at first in hot water, which coagulates the exterior albuminous ingredients, and thus forms a skin or coating which retains the most of the nutritious elements. Even in the latter case, however, some of the feeding qualities of the meat pass into the soup, and therefore the latter should be partaken of along with the meat. Till lately, the meat supplied to the soldiers of the British army was boiled, and the soup being thrown away, the

boiled meat was alone given in the rations. This system of robbing the meat of much of its strength has been done away with, and the establishment of a school of cookery at Aldershot has done much, and will still do more, to place the cooking for the army on a satisfactory footing. I trust that the medical men of the army will keep pace in the science of the soldiers' food with the military cook in the practice of that important and necessary art. Bad cooking undoubtedly leads to much waste of useful material; whilst good cooking may be regarded as a saving of the necessaries of life.

Recently, much public attention has been directed to the plan of reducing corpulent personages, known as the Banting system. There can be no doubt that the plan has been successful in giving the necessary relief to many persons, but I am strongly of opinion that there is great cause for the protest which Dr Edward Smith has made in regard to the adoption of this plan by all and sundry of our more corpulent brethren, and the necessity for caution being observed in adopting the system, except under medical supervision.

The true cure for corpulence is a restriction in the absolute quantity of food, more than in the relative proportions of the constituents. The abstraction of starch, sugar, and such like heat-producing or carbon elements, and the supplying of flesh-forming or nitrogen elements in their stead, can only lead to an unnatural diet, which loads the system with a superabundance of the flesh-forming or nitrogen elements.

In the diet of a large number of prisons, Mr Chadwick has observed a curious anomaly in regard to the effect of an increased amount of stimulating food. Out of 104 prison returns, he contrasts the health of the prisoners in relation to the quantity and expense of the diet. Thus—

	Food per week in ounces.	Cost per head per week.	Sick in 100.	Deaths in 1000.
20 prisons, lowest diet,	188	1s. 10½d.	3	1½
20 „ medium diet,	213	2s. 4½d.	18	3
20 „ highest diet,	228	3s. 2d.	23½	4

Augmentations of food, therefore, are apparently mischievous, and where the diet does not exhibit satisfactory results, recourse should be had to variety of food rather than to increased quantity.

In so simple a matter as the condition in which food should be partaken of, there is even a difference of opinion. The *high* condition in which game is often eaten in this country is open to question in a health point of view, as there can be no chemical difference between a putrefying grouse or black cock and a putrefying leg of mutton or roast of beef. The inhabitants of the Faroe Islands consume their meat in a decayed state, and conclude their meal by a tit-bit of flesh, fowl or fish, which is full of live maggots. The Faroese are very subject to intestinal complaints.

Another important matter which claims special attention at the

present day is the question of public health ; and whilst it is not my desire to enlarge upon the topic as to whether smells or stinks are bad things to live amongst, or whether it is advisable to remove from our neighbourhood the effete and putrefying remains of our ever-decaying bodies—believing, as I do, that common sense dictates that stinks are not only abominable but pernicious when they are given birth to by decomposing animal matter, I am still desirous that certain facts in regard to public health should be laid before you.

Our knowledge regarding sanitary matters has been principally collected and arranged by the labours of the Earl of Shaftesbury, Southwood Smith, Edwin Chadwick, Rawlinson, Simon, and Dr Farr; and the Public Health Act of England, introduced first in 1848 and revised in 1858, as well as the Police Improvement (Scotland) Act of 1862, are the results of the knowledge obtained in sanitary affairs, and the public expression of the opinion that much can be done to remove causes of disease and ill-health, and alleviate, to some extent at least, the miseries of our poorer brethren and of ourselves.

The average death-age of the people of England is 46 years, and it is considered by sanitary reformers that if the various conditions essential to the preservation of perfect health attainable by man were complied with, that the death-age need not be less than 80 years. In certain of the agricultural districts of England, comprehending a population of 1,000,000 persons, the rate of mortality is 17 in 1000 ; whilst the worst urban districts show a death-rate of 36 in 1000, and the average of all England is 22 in 1000. About half a million people die in England every year, and if the average mortality could be reduced from 22 to 17 in 1000, which is the death-rate of the better districts, there would be a saving of 100,000 lives every year.

The average death-rate in any country is necessarily much influenced by the position of the people, and the age of the individuals likewise leads to great variations. Thus in England :—

	AVERAGE AGE OF DEATH.		RATIO OF DEATH.
	All ages.	Adults.	Children.
Gentry, . .	44	60	1 in 4½
Small tradesmen, .	25	51	1 in 2½
Labourers, . .	22	49	1 in 2

And thus it is plainly observed that the well-to-do people have a greater expectation of life than those in less favoured circumstances.

The average death-rate in Scotland is 1 in 48 persons, which includes all districts. In the eight principal towns of Scotland the death-rate is 1 in 37 ; in Edinburgh, 1 in 42 ; in Leith, 1 in 45 ; in Fife, excluding two towns, 1 in 57 ; in four northern counties, 1 in 62 ; in four lowland counties, excluding two towns, 1 in 65 ; and in Berwickshire, 1 in 70. The increase in the mortality of a district

also denotes an increase in the sick-list—in those little illnesses which do not result in death. The 100,000 deaths regarded as preventible in England would certainly represent ten times that number, or 1,000,000, of preventible illnesses, and the mere money value of such can hardly be over-estimated. Indeed, during a life-time, the amount of sickness which falls to the average lot of us all is truly alarming when correctly estimated. One of the provident societies has shown from its statistics, that for one death of a member there are 465 days of sickness amongst the whole members, which in reality gives an average of about one and a quarter year's illness to each of their members after joining the society and before his death.

In the navy the death-rate for the three years up to 1858 was, from disease, 18·70 in 1000; and from accident, 4·53 in 1000—in all, 20·25 per 1000; and the merchant service for the same period showed a death-rate from disease of 10·98 in 1000; and from accident, 8·87 in 1000—in all 19·85 per 1000. The average death-rate in the merchant service for the ten years 1852 to 1861, was 20·66 in 1000. The men who are attached to the navy are generally picked men, ranging from 18 to 45 years of age. They have been subjected to medical inspection, and are constantly under medical supervision.

The same remarks apply to the army. Till lately the death-rate in the army at home averaged 17·5 in 1000, though now, by affording more sleeping space, and by paying more attention to the cooking of food and the clothing of the men, the average mortality has been decreased to 8½; whilst at Aldershot and Shorncliffe, by the labours of Miss Nightingale and others, the mortality on the average of the three years 1858, 1859, and 1860 was only 4·7 in 1000. This saving in the lives of the men of the army is fully 12 in 1000, and in an army of 80,000 is equal to 960 men a-year, or an entire regiment of trained soldiers. The Crimean campaign was a most disastrous one for our army in respect to sickness. From the time of leaving our shores till its return, the army, on an average strength of 34,500 men, had lost no less than 20,800 men, of whom only 5000 died in action or from wounds, and the 15,800 died from cholera, fever, and other causes. Out of 12,000 men who marched from Varna to the well-known malarial region on the south of the Danube, only 7000 returned to Varna; and so severe was the attack of disease, that out of one regiment, 300 men were attacked within a few hours, and the majority of these died. Had the army been placed in the healthier districts of England, with the mortality of these districts, only 610 deaths would have occurred from disease in the two and a-half years of the Crimean war, in place of 15,800.

The mortality in the convict prisons of England, where sanitary regulations are enforced is now very satisfactory, considering the class of people and the habits of those from whom the prisoners are

recruited. Thus the death-rate of convicts on the average of the five years 1858 to 1862 was :—

Male.....	11·86 in 1000,	or, with pardons on medical grounds,			12·82
Female,.....	13·68 in 1000,	„	„	„	16·17
Mean,.....	11·95 in 1000,	„	„	„	13·32

The average death-rate of the people of similar ages in the 24 large towns of England was 11·9 in 1000, and taking Manchester alone, 12·4 in 1000.

The health of the British army in India has called forth public attention, and has formed the subject of a royal commission on its sanitary state. The mortality among the European troops in peace and war times has averaged 69 in 1000, and this excessive proportion on the army strength of 73,000 men is equal to 5,037 deaths per annum. Much of this mortality is due to want of proper barrack-room, and to over-eating and over-drinking. The average death-rate of the native army is 20 in 1000, and in the healthy stations only 10 in 1000 ; whilst the mortality in the civil service, where the ages are similar to those of the soldiers—viz., 18 to 45 years—is, on the average of a century, only 14 to 18 in 1000. It is true that the civil servants may more readily leave the country on furlough, or ascend the mountains on sick leave, but, under any circumstances, the death-rate of 69 in 1000 of the army is excessive, where the average mortality of the civil and military service does not exceed 30 in 1000.

It is satisfactory to know that, even with our limited sanitary arrangements, the death-rate of this country contrasts favourably with that of other kingdoms. Thus the annual death-rate in various European countries is as follows :—

Scotland, ...	20·6 in 1000
England, ...	22·1 in 1000
France, ...	23·6 in 1000
Belgium, ...	25·2 in 1000
Holland, ...	27·6 in 1000

And taking Scotland alone, and determining the mortality in various parts in 1861, it is found that the death-rate was :—

Insular district, 185 inhabited islands, (population 160,733) ; . . .	16·1 in 1000
Mainland district, excluding towns of 10,000 and upwards, (population 1,763,377) ;	17·5 in 1000
Mainland district, towns of 10,000 and upwards, (population 1,138,184.) .	26·4 in 1000

The mortality amongst children is much higher than that amongst adults, and the variations in the death-rate in different localities, and under dissimilar circumstances, are much greater. Last century, the pauper infants in the London workhouses died at the rate of 23 in 24; in fact, out of the average of 2800 children, 2690 died, and thus only 1 in 24 lived till the close of the first year. An Act

of Parliament was obtained which obliged the children to be sent to the country, and the mortality decreased to 450. In happy contrast to this, we have the statistics of the Dublin Protestant Orphan Societies, where the children are boarded with poor Protestant families in Wicklow and other counties, and where the average deaths are only 1 per cent., or 10 in 1000. In England and Wales, at the present day, about 173,000 children under 5 years of age die annually, and indeed one-fourth of all the children die before they reach the fifth year.

In the north-western counties of England, the mortality among children is 2½ times as high as in the north-eastern counties, and the following are the proportions of deaths in 100 children before they reach their fifth year in several towns and localities :—

Scotland, 8 principal towns,	41·82	per cent.
Aberdeen,	32	,,
Edinburgh,	37	,,
Leith,	45	,,
Manchester,	50	,,
Glasgow,	54	,,

In Edinburgh, the annual death-rate amongst children under five years of age ranges from 48 in 1000 in the best localities to 173 in 1000 in the worst localities; and whilst the general mortality in England ranges from 15 to 30 in 1000, the death-rates of infants under 1 year of age is enormously greater, being in the

Healthy districts,	77 to 100 in 1000
Medium districts,	100 to 200 in 1000
Unhealthy districts,	200 to 300 in 1000

The causes of the excessive or preventible mortality in various localities, are partly special and partly general in their character.

The special causes of the high mortality amongst children, are improper food, scanty clothing, unhealthy parents, the administration of cordials or opiates, and bad treatment; whilst the special causes of the preventible death-rate of adults are the occupations they pursue, and the food and drink they consume. The knife and fork grinders of Sheffield suffer from the minute particles of steel-filings which are breathed into the lungs; the brass-finishers are affected in a similar way by the brass-filings; the stone-masons from the dust of stone; the coal-miners from the powder of coal; the painters, lead-smelters, and plumbers, from lead-poisoning; the artificial flower-makers, the makers of paper-hangings, and the dyers and cloth-printers from arsenical poisoning; and amongst others, the makers of lucifer matches, from the inhalation of the vapours of phosphorus.

The general causes which affect the mortality, are bad house accommodation, impure air, and filthy water. The inferior house accommodation generally leads to confined and restricted air, and in many instances also to bad water.

The amount of air which an adult vitiates in the course of the

eight hours he is asleep, is about 300 cubic feet; and as this large proportion is rendered unfit for respiration, it is reasonable to consider that double the amount, or about 600 cubic feet of air for each adult, is the smallest quantity which ought to be present in a sleeping apartment. Sanitary inquirers, and the Royal Commission which was appointed to investigate the causes which influence the sanitary condition of the army, agree in considering that the air in an apartment or barracks should be sufficient to allow every man his full allowance of 600 cubic feet, and that the quantity of air should be supplied in a good locality, where the ventilation of the apartment can be conveniently carried out.

Now, the Royal Commission, in their inquiries into the amount of space allowed to each soldier in the barracks at home, found that

1,335	men	were	living	and	sleeping	in less than	250 cubic feet.
15,195	„	„	„	„	„	350	„
34,882	„	„	„	„	„	400	„
65,271	„	„	„	„	„	500	„
only 4,656	„	„	„	in	more than	550	„
and but 2,003	„	„	„	„	„	600	„

So that only 2000 men had the full proportion of air to breathe, and there was altogether a deficiency of fully 30 per cent. in the proper quantity, or 600 cubic feet. The Royal Commission ruled, that 600 cubic feet should be the lowest proportion of air allowed to every soldier, and by Lord Herbert's exertions, improvements were carried out which yielded most satisfactory results.

The influence of the improvements in the sanitary condition of the barracks, was marked in the decided decrease in the death-rate of the troops in the United Kingdom, before and after the improved sanitary measures.

	MORTALITY OR DEATH-RATE. Average of 10 Years. 1837–1846.		In 1859.
Infantry Regiments, . .	17·9	to	7·6 in 1000
Foot Guards, . . .	20·4	to	9·1 „
Royal Artillery, . . .	13·9	to	8·0 „
Dragoon Regiments, . .	13·6	to	8·0 „

The Royal Commissioners also extended their labours to the examination of the condition of the military hospitals, and considering that a man occupies the ward during the day as well as the night, they very wisely adopted the increased amount of 1000 cubic feet of air as the smallest allowance compatible with health in a sick-room. The conditions of the military hospitals were found to be—

362	beds had	under	400	cubic feet of air.
959	„	from	400 to 500	„
820	„	„	500 to 600	„
1927	„	„	600 to 700	„
1707	„	„	700 to 800	„
705	„	„	800 to 900	„
423	„	„	900 to 1000	„
240	„	„	1000 to 1100	„
18	„	„	1100 to 1200	„
6	„	over	1200	„

So that out of 7165 beds in the military hospitals, only 264 had a proper allowance of air; and there was a total deficiency in hospital space of 42½ per cent. The new medical regulations demand, that for the future 1200 cubic feet of air shall be allowed each patient in the hospitals in temperate regions, and 1500 cubic feet in the hospitals in hot regions.

It is more difficult to trace the benefits of fresh air on the sick, but there can be no doubt that the statistics of the improved hospitals, as contrasted with the comparatively confined wards, will show a more rapid improvement in the health of the convalescents, and a diminution in the proportion of deaths.

The importance of fresh water need not be insisted upon, but the fact ought to be widely known, that the mere appearance of a water, and even its taste and odour, are not safe indications of purity. Many waters which are clear, sparkling, odourless, and tasteless, are highly contaminated with organic impurities.

One of the most satisfactory results of medical supervision in sanitary matters was observed in the case of the London postmen, who number about 2935 on town service. Before official medical supervision was carried out, as in the three years 1851, 1852, and 1853, the average mortality was 15 in 1000; whilst, after medical attendance had been provided, and even the medicines free, as during the three years 1856, 1857, and 1858, the average mortality decreased to 11 in 1000; and in the next three years, viz., 1859, 1860, and 1861, the death-rate fell to 6·3 in 1000. The improvement in the health of the postmen is ascribed mainly to greater attention being paid to the ventilation of the rooms, to the introduction of filtered water, and to the more ready attention to small ailments; though, to some extent, the results are affected by a more careful selection of men applying for vacancies.

In concluding these remarks upon sanitary matters, I need hardly remind you, that the constant wear and tear of the animal frame not only renders the air foul, but tends to fill up the pores of the skin; and that attention should specially be directed to cleanliness of person through frequent use of baths. No statistics have been specially obtained to show the benefits of public baths in the general community; but ample testimony of the good accruing from the frequent use of the bath is afforded by individual experience; and it is only right and proper that part of the great sanitary improvements in the health of the inhabitants of Liverpool and other of our larger towns, should be ascribed to the institution of public baths. Many people have a strange repugnance to ablutions in general, and this appears to be exhibited by all nations. Livingstone speaks of a native who followed his party in spite of all remonstrances, until the Makololo threatened to take him to a river and wash him, and then he decamped, doubtless fearing that his garment of castor-oil and dirt would be lost, and he would then be cold and uncomfortable.

The great question of the disposal of the sewage of towns, is one

I do not wish to enter upon here, as I have only recently discussed the matter at association meetings in Bath and in York; and I am desirous of avoiding the appearance of constantly referring to the same topic; but I am anxious to say this much, that whatever is ultimately done with the sewage of a town, it is right and proper that that sewage should be conveyed away from the city and its inhabitants. The cesspool system, as carried out in our smaller towns and villages, is an abomination, and leads to the contamination of the well-waters with foul matters of a disgusting and highly pernicious nature.

The benefits derivable from the improved drainage of towns may be learned from the following statistics:—

In 19 towns in England which were improved under the Public Health Act, the average mortality before the drainage operations was 28 in 1000, whilst, after drainage, the death-rate decreased to 21 in 1000; and this, in a population of 468,000 people, gives an annual saving of 3200 lives. In Liverpool, in 1846, the mortality was 39 in 1000; whilst the improvements carried out in drainage, improved water-supply, etc., decreased the mortality, till in 1860, it was only 24·2 in 1000, with a saving of about 5000 lives annually. Macclesfield, on the average of five years before sanitary improvements, had a death-rate of 33 in 1000, and on the average of five years after the drainage operations 26 in 1000; or the average duration of life in the whole population was increased from 24 years to 27 years. By similar improvements in drainage and other sanitary operations, the mortality of Gloucester fell from 27·60 to 19·71; of Bradford, from 28½ to 22; of Croydon, from 28·16 to 22·9; and of Berwick, from 28·5 to 21·7.

Had your time permitted, I would have desired to refer to other topics of interest at the present time, such as the indestructibility of matter and of force, leading to the conservation of force, and its relations to the animal structure, and how the food of the animal not only ministers to the growth and sustainment of the bodily frame, but also supplies the force which is exerted by each of us in our daily work, whether that be the work of the hand or of the head. But I trust I have said sufficient, on subjects collateral with strict medicine and surgery, to show you that there are various topics of vast interest to the public in general, of which the medical practitioner ought to be cognizant. He ought to remember always, that his professional vocation is next to that of the clergyman, the most noble and sacred of all professions, and that his position in life demands that he possess an enlightened knowledge of even every-day and common-sense subjects. True science should be studied for its own sake,—for the knowledge it gives us of the workings of the great world around us, and the insight it affords us of the beneficent plans and designs of the great Creator and Upholder of the Universe.

EDINBURGH: PRINTED BY OLIVER AND BOYD.